Table 3-1
CURRENT YEAR SO_2 EMISSIONS FOR POWER PLANTS

Based on CEMS data from EPA's Acid Rain Database

Source	1999 Actual Emissions			2000 Actual Emissions			**Current Year Emissions**	
	max 24 hour [lb/hr]	90 % 24 hour [lb/hr]	annual [TPY]	max 24 hour [lb/hr]	90 % 24 hour [lb/hr]	annual [TPY]	**2yr-90% 24 hour [lb/hr]**	**2-yr avg annual [TPY]**
Basin Electric Power Cooperative - Antelope Valley Station								
Units 1 + 2	4,350	3,620	15,516	4,940	3,291	13,047	**3,598**	**14,282**
Otter Tail - Coyote Station								
Unit 1	5,799	5,126	20,040	5,115	4,655	14,521	**5,077**	**17,281**
Great River Energy - Coal Creek								
Unit 1[1]	7,744	7,194	23,551	5,287	4,195	14,332	**4,195**	**14,332**
Unit 2[1]	7,175	6,891	26,192	4,608	3,552	12,817	**3,552**	**12,817**
PPL Corp. - Colstrip (Montana)								
Unit 3[2]	n/a	n/a	3,030	n/a	n/a	2,859	**672**	**2,945**
Unit 4[2]	n/a	n/a	3,293	n/a	n/a	2,315	**640**	**2,804**
Minnkota Power Cooperative - Milton R. Young Station								
Unit 1	7,088	5,575	19,481	7,082	5,599	18,095	**5,575**	**18,788**
Unit 2	7,535	6,161	21,863	6,838	6,089	21,134	**6,128**	**21,499**
Basin Electric Power Cooperative - Leland Olds Station								
Unit 1	5,956	4,891	16,802	5,970	4,965	16,864	**4,931**	**16,833**
Unit 2	11,623	10,282	33,306	11,796	9,877	28,587	**10,179**	**30,947**
Montana-Dakota Utilities Co. - Heskett Station								
Unit 1	1999 CEMS data not available			537	348	1,022	**348**	**1,022**
Unit 2	1,227	833	2,208	1,080	822	1,778	**831**	**1,993**
Great River Energy - Stanton Station								
Unit 1	3,078	2,371	8,241	3,047	2,523	7,017	**2,456**	**7,629**
Unit 10	357	327	1,241	402	307	972	**320**	**1,107**

Source	1999 Actual Emissions			2000 Actual Emissions			**Current Year Emissions**	
	max 24 hour [lb/hr]	90 % 24 hour [lb/hr]	annual [TPY]	max 24 hour [lb/hr]	90 % 24 hour [lb/hr]	annual [TPY]	**2yr-90% 24 hour [lb/hr]**	**2-yr avg annual [TPY]**
TOTAL	**63,931**	**53,271**	**194,764**	56,702	**46,223**	**155,360**	**48,502**	**164,277**

[1] Current year emissions are based on year 2000 CEMS data only. See discussion above.

[2] 24-hour current year emissions are based on annual CEMS data divided by 365 days. See discussion above.

No CEMS data or recent emissions data were readily available for the two gas processing plants (Grasslands Gas and Little Knife Gas Plant) and the coal gasification plant (Greatplains Synfuels Plant), so EPA used the same emissions estimates that NDDH used in their 1999 draft study. Modeled short-term emission rates for these plants are as follows:

Grasslands Gas Plant:	273 lb/hr
Little Knife Gas Plant:	427 lb/hr
Dakota Gasification - Greatplains Synfuels Plant:	3323 lb/hr

3.2 Base Year Inventory

As in the current year inventory, emissions for the base year inventory are generally based on actual emissions reflected by normal source operation for a period of 2 years. The two-year study period should generally be the two years preceding the minor source baseline date, provided that the two-year period is representative of normal source operation. Another two-year period may be used, only if that other period of time is more typical of normal source operation than the two years immediately preceding the baseline date (see 45 FR 52718, August 7, 1980). EPA rules and guidance allow the potential to emit to be used if little or no operating data are available, as in the case of a permitted emission unit constructed before the major source baseline date but not yet in operation at the time of the minor source baseline date (see 40 CFR 51.166(b)(13), p. C.11 of the NSR workshop manual[6], and 45 FR 52718, col. 3, August 7, 1980).

Four of the seven coal-burning power plants in North Dakota commenced construction before the major source baseline date for SO_2 (January 6, 1975). These include Minnkota Power Cooperative's Milton R. Young Station (Units 1 and 2), Basin Electric Power Cooperative's LeLand Olds Station (Units 1 and 2), Montana-Dakota Utilities Company's Heskett Station (Units 1 and 2) and Great River Energy's Stanton Station (Unit 1). These units are all included in the major source base year emission inventory. No major sources in this analysis that were built before the major source baseline date reported any physical change or change in the method of operation after the major source baseline date but before the minor source baseline dates (*i.e.*, all emissions prior to the applicable minor source baseline dates are considered to be baseline emissions).

Following is a brief description of each baseline source, based on information from EPA's Acid Rain Database (see http://www.epa.gov/airmarkets/picturethis/index.htm):

Minnkota Power Cooperative - Milton R. Young Station
Unit 1 - 257 MW, lignite-fired cyclone boiler, uncontrolled for SO_2
Unit 2 - 477 MW, lignite-fired cyclone boiler, SO_2 control - (dry alkali) flue gas desulfurization

Basin Electric Power Cooperative - Leland Olds Station
Unit 1 - 216 MW, lignite-fired dry bottom boiler, uncontrolled for SO_2
Unit 2 - 440 MW, lignite-fired cyclone boiler, uncontrolled for SO_2

Montana-Dakota Utilities Co. - Heskett Station
Unit 1 - 25 MW, lignite-fired, uncontrolled for SO_2
Unit 2 - 75 MW, lignite-fired boiler retrofitted to a fluidized bed combustor in 1987, uncontrolled for SO_2

Great River Energy - Stanton Station
Unit 1 - 187 MW, lignite-fired dry bottom boiler, uncontrolled for SO_2

3.2.1 Base Year Inventory for North Dakota Class I Areas

In general, the base year inventory for the North Dakota Class I areas is based on actual emissions averaged over the two-year period 1976-1977. For all baseline emissions we used AP-42 emission factors for uncontrolled lignite-fired boilers (see AP-42[8], section 1.7, Table 1.7-1).

The only data available to us for these baseline sources for the years 1976 and 1977 are what is reported to the State in the Annual Emission Inventory Reports (*e.g.*, coal use, sulfur content, coal feed rates, etc.). Based on this information, several options existed for determining the short term maximum actual emission rates needed for the modeling analysis.

One option for determining short-term emissions is to calculate an emission rate based on an AP-42 emission factor (in units of lb_{SO2}/ton_{coal}) and the maximum sulfur content (wt. %) and maximum coal feed rate (ton_{coal}/hr) supplied in the Annual Emission Inventory Reports. However, we believe that the maximum coal feed rate numbers are very uncertain. We are not aware of any official method or quality assurance process that has been used to arrive at these numbers. According to the State, at least one company has questioned the accuracy of these data. For these reasons, we dismissed this option for calculating short-term emissions. In using maximum hourly feed rates and maximum sulfur content, this option would likely overpredict SO_2 emissions in the base year.

---

[8] Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, January 1995, EPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, http://www.epa.gov/ttn/chief/ap42/index.html.

A second option for determining short-term emissions is to calculate annual emissions (based on an AP-42 emission factor (in lb_{SO2}/ton_{coal}), average sulfur content (in wt. %) and annual coal usage (in ton_{coal}/yr)) and divide this number by 365 days per year to arrive at a lb per day emission rate. Since this method is based on *average* annual operation data, this option would likely underpredict SO_2 emissions in the base year. For this reason we also dismissed this option, except as a screening approach for sources with very low emission rates, or at great distances from the Class I areas.

A third option for determining short-term emissions is to calculate annual emissions (again, based on an AP-42 emission factor (in lb_{SO2}/ton_{coal}), average sulfur content (in wt. %) and annual coal usage (in ton_{coal}/yr)) and then apply the peak-to-mean ratio from the current year CEMS emissions to the mean annual base year emissions to get peak base year emissions. Specifically, the ratio of the annual average emission rate from the 1999-2000 CEMS data to the 90^{th} percentile 24-hr emission rate (from 1999-2000 CEMS data) is applied to the annual average emission rate in the base year to calculate the 24-hr emission rate in the base year. Since short-term emission rates in the current year inventory are based on the 90^{th} percentile of the 24-hour average (see Section 3.1), this option would give the best estimate of the 90^{th} percentile 24-hr emission rate in the base year and would, therefore, be consistent with the short-term emissions used in the current year inventory. For this reason we chose this option for calculating short-term SO_2 emissions in the base year.

EPA believes any increment analysis should follow the same methodology for determining emissions in the base year as in the current year, particularly where like data are available, as is the case here. Using the same methodology allows an objective comparison (and use) of the two data sets. To do otherwise does not provide "comparable" data sets. If different methodologies were used to determine emissions for the base year and the current year, comparing the two data sets would produce inappropriate conclusions since the data sets had been derived using different methodologies.

Annual average emissions (for use in option 3 above) are based on an AP-42 emission factor for uncontrolled lignite-fired boilers of 30 S (see AP-42, section 1.7, Table 1.7-1). Annual Emission Inventory Reports for each baseline source were obtained from the State of North Dakota for 1976 and 1977. From these reports, annual coal usage and average sulfur content data were used to calculate annual average SO_2 emissions. For example, annual average base year SO_2 emissions for Minnkota's Milton R Young Unit 1 are:

$$SO_2\ emissions_{1976}\ [TPY] = 30 * (0.52\%) \frac{lb_{SO2}}{ton_{coal}} * 1{,}581{,}000 \frac{ton_{coal}}{yr} * \frac{1\,ton_{SO2}}{2000\,lb_{SO2}} = 12{,}332 \frac{ton_{SO2}}{yr}$$

$$SO_2\ emissions_{1977}\ [TPY] = 30 * (0.63\%) \frac{lb_{SO2}}{ton_{coal}} * 1{,}527{,}511 \frac{ton_{coal}}{yr} * \frac{1\,ton_{SO2}}{2000\,lb_{SO2}} = 14{,}435 \frac{ton_{SO2}}{yr}$$

$$2yr\ average\ SO_2\ emissions\,[TPY] = \frac{(12{,}332 + 14{,}435)}{2} = \underline{\underline{13{,}383\ TPY}}$$

Short-term emissions are then calculated based on the peak-to-mean ratio from current year emissions. For example, short-term SO_2 base year emissions for Minnkota's Milton R Young Unit 1 boiler are:

$$peak-to-mean\ ratio_{1999-2000} = \frac{18{,}788\,\frac{ton}{yr}\,(2yr\ annual\ avg_{1999-2000})}{5575\,\frac{lb}{hr}\,(90^{th}\%\ 24hr\ avg_{1999-2000}) * \frac{8760\,hr}{yr} * \frac{ton}{2000\,lb}} = 1.30$$

$$base\,year\,SO_2\ emissions[\frac{lb}{hr}] = 13{,}383\frac{ton}{yr} * 1.30 * \frac{yr}{8760hr} * \frac{2000lb}{ton} = \underline{\underline{3972\frac{lb}{hr}}}$$

For the most part we used the above method for calculating base year emissions. However there are a few exceptions. Minnkota's Milton R Young Unit 2 had only been in operation for 9 months as of the minor source baseline date and those 9 months do not appear to be representative of normal operating conditions. The unit was apparently out of compliance with its allowable emissions for many months after the unit began operation. Considering that we do not have two years of actual emissions at the time of the minor source baseline date for this unit, as well as the fact that the unit really did not begin "normal operations" until after the baseline date was triggered, we believe it is appropriate in this situation to consider the allowable emissions of Minnkota's Unit 2 as its emissions at the time of the baseline date (see 45 FR 52718, col. 3, August 7, 1980). Furthermore, since any emissions increases above a source's allowable emission rate at the time of the minor source baseline date must be considered as increment consuming emissions, it would not be appropriate to use Unit 2's actual emission rate at the time of the minor source baseline date as the baseline emission rate. Therefore, we modeled a short-term emission rate of 5635 lb/hr (the allowable emission rate) for this unit.

The other exception in calculating baseline emissions is for Montana-Dakota Utilities Co.'s Heskett Unit 1 emissions. Since Heskett Unit 1 is not an acid rain source, no CEMS emissions are reported to the Acid Rain Database. Hourly CEMS data were only available for the year 2000 from the State of North Dakota. Therefore, the peak-to-mean ratio used to calculate short-term emissions in the base year is only based on year 2000 data (as opposed to both 1999 and 2000 data, used for all other baseline sources).

Baseline emissions for the Class I areas in North Dakota are summarized in Table 3-2.

Table 3-2

SO_2 BASELINE EMISSIONS FOR **NORTH DAKOTA** CLASS I AREAS

Based on AP-42 and annual emission inventory reports provided by ND for 1976-1977

SO_2 minor source baseline date = December 17, 1977

Source	Emission Factor	1976 Actual Emissions			1977 Actual Emissions			**Baseline Emissions**	
	$[lb_{SO_2}/ton_{coal}]$	avg. S [%]	coal burned [TPY]	annual emissions [TPY]	avg. S [%]	coal burned [TPY]	annual emissions [TPY]	**annual [TPY]**	**24-hr[1] [lb/hr]**
Minnkota Power Cooperative - Milton R. Young Station									
Unit 1	30(S)	0.52	1,581,000	12,332	0.63	1,527,511	14,435	**13,383**	**3,972**
Unit 2[2]	n/a	n/a	n/a	24,682	n/a	n/a	24,682	**24,682**	**5,635**
Basin Electric Power Cooperative - Leland Olds Station									
Unit 1	30(S)	0.45	1,255,995	8,478	0.44	1,306,785	8,625	**8,551**	**2,499**
Unit 2	30(S)	0.45	1,958,680	13,221	0.44	1,964,660	12,967	**13,094**	**4,305**
Montana-Dakota Utilities Co. - Heskett Station									
Unit 1	30(S)	0.75	159,196	1,791	0.68	171,162	1,746	**1,768**	**602**
Unit 2	30(S)	0.75	376,017	4,230	0.68	406,145	4,143	**4,186**	**1,749**
Great River Energy - Stanton Station									
Unit 1	30(S)	0.65	746,205	7,275	0.64	737,106	7,076	**7,176**	**2,310**
TOTAL								**72,841**	**21,072**

[1] Based on the ratio of annual average emission rate (from 1999-2000 CEMS data) to the 90th percentile 24-hr emission rate (from 1999-2000 CEMS data) applied to the annual average emission rate in the base year.

[2] Unit 2 had only been operating 9 months as of the minor source baseline date (12/19/77) and those 9 months were not considered representative of actual operation. Therefore, allowable emissions were used to determine baseline emissions. See 45 FR 52718, col. 3, August 7, 1980.

3.2.2 Base Year Inventory for Montana Class I Areas

In general, the base year inventory for the Montana Class I areas was compiled using the same method as for the North Dakota Class I inventory. The only difference is the use of 1977 and 1978 emission inventory data for calculating the annual average emission rates. While we still used allowable emissions for Minnkota's Milton R Young Unit 2 in 1977, we were able to calculate actual emissions for 1978. Since Unit 2 commenced construction after August 17, 1971, it was permitted according to the New Source Performance Standards (NSPS) in 40 CFR

Part 60 Subpart D. Therefore, we calculated actual emissions for the unit based on this 1.2 lb_{so2}/mmBtu standard, the average heat content of the coal in 1978 and the annual coal usage rate for that year. We then applied the peak-to-mean ratio from 1999-2000 CEMS data to calculate a short-term emission rate and averaged that with the 1977 allowable emission rate of 5635 lb/hr to arrive at a short-term emission rate for the unit for the base year. Other possibilities we considered for determining baseline emissions for this unit were: (1) to just use the 1978 actual numbers (not averaged with the allowable emissions for 1977); and (2) to use the allowable emission rate for both 1977 and 1978 emissions. EPA solicits comments from the public on how to determine the most representative baseline emission rate for this source.

Baseline emissions for the Class I areas in Montana are summarized in Table 3-3.

Table 3-3

SO_2 BASELINE EMISSIONS FOR **MONTANA** CLASS I AREAS

Based on AP-42 and annual emission inventory reports provided by ND for 1977-1978

SO_2 minor source baseline date = March 26, 1979

Source	Emission Factor [lb_{SO_2}/ton_{coal}]	1977 Actual Emissions			1978 Actual Emissions			**Baseline Emissions**	
		avg. S [%]	coal burned [TPY]	annual emissions [TPY]	avg. S [%]	coal burned [TPY]	annual emissions [TPY]	**annual [TPY]**	**24-hr[1] [lb/hr]**
Minnkota Power Cooperative - Milton R. Young Station									
Unit 1	30(S)	0.63	1,527,511	14,435	0.65	1,427,485	13,918	**14,176**	**4,208**
Unit 2[2]	1.2 lb/mmBtu	n/a	n/a	24,682	0.65	1,956,191	15,087	**19,884**	**4,970**
Basin Electric Power Cooperative - Leland Olds Station									
Unit 1	30(S)	0.44	1,306,785	8,625	0.74	1,361,539	15,113	**11,869**	**3,469**
Unit 2	30(S)	0.44	1,964,660	12,967	0.74	2,435,160	27,030	**19,999**	**6,575**
Montana-Dakota Utilities Co. - Heskett Station									
Unit 1	30(S)	0.68	171,162	1,746	0.71	161,755	1,723	**1,734**	**590**
Unit 2	30(S)	0.68	406,145	4,143	0.71	342,560	3,648	**3,895**	**1,628**
Great River Energy - Stanton Station									
Unit 1	30(S)	0.64	737,106	7,076	0.61	577,004	5,280	**6,178**	**1,989**
TOTAL								**77,736**	**23,428**

[1] Based on the ratio of annual average emission rate (from 1999-2000 CEMS data) to the 90th percentile 24-hr emission rate (from 1999-2000 CEMS data) applied to the annual average emission rate in the base year.

[2] Unit 2 had only been operating 9 months in 1977 and those 9 months were not considered representative of actual operation. Therefore, allowable emissions were used to determine 1977 emissions. See 45 FR 52718, col. 3, August 7, 1980. 1978 emissions are based on an emission limit of 1.2 lb_{SO_2}/mmBtu for NSPS boilers (see 40 CFR Part 60 Subpart D) and an average heat content of 6427 Btu/lb_{coal}.

3.3 Increment Consuming Emissions

Tables 3-4 and 3-5 summarize the increment consuming emissions from the inventories in Section 3.1 (Current Year Emissions) and 3.2 (Base Year Emissions).

Table 3-4
SO_2 INCREMENT CONSUMING EMISSIONS FOR **NORTH DAKOTA** CLASS I AREAS

Source	Base Year Emissions		Current Year Emissions		Increment Consuming Emissions[1]	
	24-hr[2] [lb/hr]	annual [TPY]	24-hr[3] [lb/hr]	annual [TPY]	24-hour [lb/hr]	annual [TPY]
Basin Electric Power Cooperative - Antelope Valley Station						
Units 1+2	n/a	n/a	3,598	14,282	3,598	14,282
Otter Tail - Coyote Station						
Unit 1	n/a	n/a	5,077	17,281	5,077	17,381
Great River Energy - Coal Creek Station						
Unit 1[4]	n/a	n/a	4,195	14,332	4,195	14,332
Unit 2[4]	n/a	n/a	3,552	12,817	3,552	12,817
PPL Corp. - Colstrip (Montana)						
Unit 3	n/a	n/a	672	2,945	672	2,945
Unit 4	n/a	n/a	640	2,804	640	2,804
Minnkota Power Cooperative - Milton R.Young Station						
Unit 1	3,972	13,383	5,575	18,788	1,603	5,405
Unit 2[5]	5,635	24,682	6,128	21,499	493	(3,184)
Basin Electric Power Cooperative - Leland Olds Station						
Unit 1	2,499	8,551	4,931	16,833	2,432	8,282
Unit 2	4,305	13,094	10,179	30,947	5,874	17,853

Source	Base Year Emissions		Current Year Emissions		Increment Consuming Emissions[1]	
	24-hr[2] [lb/hr]	annual [TPY]	24-hr[3] [lb/hr]	annual [TPY]	24-hour [lb/hr]	annual [TPY]
Montana Dakota Utilities Co. - Heskett Station						
Unit 1[6]	602	1,768	348	1,022	(254)	(746)
Unit 2	1,749	4,186	831	1,993	(918)	(2,193)
Great River Energy - Stanton Station						
Unit 1	2,310	7,176	2,456	7,629	146	453
Unit 10	n/a	n/a	320	1,107	320	1,107
Gas Processing Plants						
Grasslands	n/a	n/a	273	n/a	273	n/a
Little Knife	n/a	n/a	427	n/a	427	n/a
Dakota Gasification Plant						
Greatplain Synfuels	n/a	n/a	3,323	n/a	3,323	n/a
TOTAL	**21,072**	**72,840**	**52,525**	**164,277**	**31,453**	**91,538**

[1] Negative numbers indicate increment expanding emissions (*i.e.*, current year emissions are lower than base year emissions).

[2] Annual numbers are based on the Annual Emission Inventory Reports from 1976-1977 (e.g., *avg* S, annual coal use) and AP-42 emission factors. 24-hr numbers are based on the ratio of the annual average emission rate (from 1999-2000 CEMS data) to the 90th percentile 24-hr emission rate (from 1999-2000 CEMS data) applied to the annual average emission rate in the base year.

[3] Based on the 90th percentile of the 24-hr average from 1999 and 2000 CEMS data.

[4] Based on 2000 CEMS data only.

[5] Unit 2 had only been operating 9 months as of the minor source baseline date (12/19/77) and those 9 months were not considered representative of actual operation. Therefore, allowable emissions were used to determine baseline emissions. See 45 FR 52718, col 3, August 7, 1980.

[6] Current year emissions based on 2000 CEMS data only. Unit 1 does not report to the Acid Rain Database; hourly CEMS data were only available for 2000 from the State.